

MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

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No. 7.

J. R. HIND, Esq., President, in the Chair.

Thomas Buckney Esq., 61 Strand, W.C. ;

Lindsay Atkins Eddie, Esq., Oatlands, Grahamstown, Cape of Good Hope ;

Thomas Gullon, Esq., Northenden, Cheshire ; and

Signor N. Perini, 261, Hampstead Road, N.W. ;

were balloted for and duly elected Fellows of the Society.

Notice.—The Council have made arrangements for distributing by post to Fellows of the Society Ephemerides of Comets and other information of immediate interest. Any Fellow who may wish to receive such information is requested to forward his name to the Assistant Secretary, Royal Astronomical Society, Burlington House, London, W.

It is desired that early information respecting Comets may be sent direct to W. H. M. Christie, Royal Observatory, Greenwich, London, S.E., in order that it may be distributed without delay.

On the Preparations to be made for observation of the Transit of Venus 1882, December 6. By Sir G. B. Airy, K.C.B., Astronomer Royal.

Whatever we may consider as concluded from the observations of the Transit of *Venus*, 1874, I think we may well believe that the scientific world will not be satisfied unless we take the opportunity of securing all that can be obtained from the Transit

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of 1882: such an opportunity as will recur only after the extinction of three generations of mankind. It is not now too early to examine into the circumstances of that Transit, and to decide provisionally on the sites to be adopted, the observations that may most advantageously be taken, and the means of carrying them out.

We approach this Transit under conditions far more favourable than those under which we undertook the observations of 1874. We have the personal experience of observers who are still living among us, and our minds are still occupied with the discussions to which their observations gave rise. In external circumstances a great step has been gained by the extension of electric telegraphs, upon which we may rely for delivering us from that which was the most laborious and most expensive part of the Transit of 1874—namely, the determination of longitudes of stations. And, finally, I believe I can show that, by departing in some respects from the plan which I proposed many years ago, and laying greater stress upon considerations which I then treated more lightly, we may adopt a course which seems to possess all the elements of success.

I wish first to call attention to this point: that a most important condition for trustworthy observation is a sufficient elevation of the Sun above the horizon. For this advantage it will be well sometimes to sacrifice something in the magnitude of the parallax-factor; especially where observations can be obtained at several neighbouring stations: I am inclined to fix upon the elevation 20° as one that ought to be secured if possible: though an elevation of 15° may sometimes be accepted as sufficient.

This being premised, I proceed to indicate the stations which I consider most advantageous.

Transit of Venus 1882.

INGRESS ACCELERATED.

For this phenomenon, I propose to rely entirely on the Cape Colony, employing as many stations as can be manned from the Cape Observatory to D'urban.

As regards absolute longitude: relying upon that of Aden (determined in 1874), and remarking that telegraph is complete thence to D'urban, and that all authorities—and especially the Telegraph Company—are anxious to promote this determination, I cannot doubt that, under Mr. Gill, the longitude of the Cape Observatory will be quickly ascertained. Then as regards the actual observation of the Transit: telegraph exists along the whole coast, and all observations will be at once referred to Cape Observatory time, and thus to Greenwich time.

The Sun's elevation ranges from about 33° to about 46° . (At

Kerguelen and Mauritius the elevation is only 10° : at the south point of Madagascar it is 21° .)

The factor of parallax is about 0.65: This is the smallest that I propose to use; but its smallness is, in my opinion, abundantly compensated by the other very favourable circumstances.

The Ingress will also be visible in Britain, Belgium, France, Spain, and part of Africa. At Land's End and Valentia the Sun's elevation will be about 14° , at Greenwich about 10° , with factor 0.65. For the other countries, the circumstances are less favourable.

INGRESS RETARDED.

I proposed formerly to refer principally to the coasts of the Canadian Dominion and the United States of North America. But (without wishing to discourage observations there) I now think that the elevation of the Sun, 15° to 18° , is too small. I propose to substitute the whole chain of the West India Islands, from the eastern extremity of Cuba to Barbadoes: or stations on the neighbouring continent of Central America. The Hydrographic Office of the United States has determined with great accuracy the longitude of Havana, Santiago de Cuba, Kingston (Jamaica), Aspinwall, Panama, San Juan de Puerto Rico, St. Thomas, St. Croix, St. John of Antigua, St. Pierre of Martinique, Bridgetown of Barbadoes, Port Spain of Trinidad. At any of these it will be only necessary to determine local time at the observation.

The Sun's elevation ranges from about 23° to 43° .

The factor of parallax from about 0.75 to 0.85.

Bermuda also is very favourably situated, with Sun's elevation about 25° and factor of parallax about 0.90. But I believe that its longitude is not so well determined.

EGRESS ACCELERATED.

All the stations suggested for Ingress retarded may be adopted with advantage for Egress accelerated. The Sun's elevation at Bermuda will be about 13° , that for Charleston 22° , that for the chain of islands about 25° , and that for the continental stations about 35° . The parallax-factor ranges from about 0.7 to 0.9.

EGRESS RETARDED.

Although the Egress can be observed at Melbourne with elevation 10° , and at Sydney and the whole eastern coast of New South Wales with elevation 14° , and the French will probably adopt New Caledonia with 22° elevation, yet I should be inclined to rely more completely upon New Zealand. There is nothing to prevent determination of the longitude of points of Australia, if a proper department of State would take it up, the telegraphic

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communication being complete. For that of New Zealand, though considerable progress was made by Major Palmer in a series of Lunar Transits at Burnham, yet I think them scarcely sufficient for our purpose; and, if no telegraph be completed, I would propose some runs of chronometers, on which I have learned to place much reliance.

The Sun's elevation on the east coast of Australia (as stated above) would be perhaps 14° ; that at Hobart Town 14° ; that in New Zealand 30° to 35° .

The factor of parallax in Australia about 0.96; that in New Zealand about 0.83.

I will now advert to the instruments to be carried out.

For Local Time, at a station where the residence is to be one of considerable length, no instrument is comparable to the ordinary transit-instrument. But for short residences, intended to be no longer than is necessary for determining the state of the clock, and (if required) the local latitude, the most convenient instrument is a vertical circle, or altazimuth with no azimuth-circle or no accurately-divided azimuth-circle. (If, however, a survey for defining the place for observation should be contemplated, the azimuth-circle would be useful.) By using the vertical circle on two known stars in azimuth distant nearly 90° (it matters not in what portions of the azimuthal circumference nor at what elevation), latitude and clock-error are determined without difficulty. I should recommend the adoption of this instrument, where it can be obtained, in preference to any other. As everything depends upon its fitness for use, it ought to be furnished with duplicates of the parts most likely to be injured or lost—as levels and eye-pieces.

A good sidereal clock is indispensable, and a solar chronometer almost equally necessary.

For observation of the Transit, there ought to be a 6-inch telescope equatorially mounted, with clock-work movement, and with careful provision in the eye-piece against the sun's radiant heat. Experiments on the efficiency of this protection ought previously to be made in the heat of the summer sun. And, if possible, another 4 or 5-inch telescope, similarly protected, ought to be furnished. A portion of these instruments can at once be supplied from the Royal Observatory.

It is decided, by almost unanimous consent, that no real assistance can be obtained by application of photography.

I should endeavour to dispense with framed huts and revolving roofs, thinking it possible that we may sufficiently trust to waterproof cloth coverings, or to such buildings (greenhouse, for instance, or ordinary shed) as may be found on the spot.

If at any station another competent observer can be found, and if the climate is uncertain, and if communications of time can be kept up (but not otherwise), a separation of the telescopes might

be advantageous. And it may be an important element of success that there be easy communication with the telegraph-office.

I have only further to remark that it is desirable that the history of the phenomena noted at each of the stations of past Transits should be carefully perused in making arrangements for this which is approaching. And I avow that some injury resulted to the observations in 1874 for want of this preparation. Attention had been so completely concentrated on the Transit of 1769, as affording a determination of Solar Parallax free in great measure from the effect of doubts on longitude, that the observations made in the Transit of 1761 were almost entirely neglected. But the Transit of 1761, partly visible in Europe, was, in fact, more extensively observed, and perhaps by abler professional observers, than that of 1769. There are numerous records of the observations of 1761 in the following volumes of the *Philosophical Transactions*. Among the results there is one—namely, the ring of light round the planet *Venus*—which, had it been known to our observers, would have saved them from some trouble, and possibly some inaccuracy, in the observations of 1874.

Note in Correction of a Passage in his Paper "On the Theoretical Value of the Acceleration of the Moon's Mean Motion in Longitude" (Monthly Notice 1880, April). By Sir G. B. Airy, K.C.B., Astronomer Royal.

It has been pointed out to me by Professor Adams that the second part of Paragraph 16 in the paper on Acceleration has no foundation. This is perfectly clear, inasmuch as the factor $\frac{\sigma}{A^3}$,

which is proportional to $\frac{1}{T^2}$ (T being put for the length of the year), is invariable so long as the year is invariable. With change of A, σ must be changed. I cannot explain the occurrence of this error, except by the remark that the paragraph in question was written last of all—a circumstance which, as I well know, tends powerfully to increase probability of error.

1880, May 15.
